Title: **A Xenolith Perspective on the Composition and Age of the Northern Tanzanian Lithosphere (Invited)**

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Keywords: 1020 Geochemistry / Composition of the continental crust, 1025 Geochemistry / Composition of the mantle, 3615 Mineralogy And Petrology / Intra-plate processes, 3621 Mineralogy And Petrology / Mantle processes

Abstract

Study of deep crustal and upper mantle xenoliths from rift volcanoes throughout northern Tanzania provides insights into the architecture of the Tanzanian lithosphere, as well as the interaction of this lithosphere with rift magmas. Like the upper crust, the lower crust and mantle lithosphere of the Tanzanian Craton (TC) and Mozambique Belt (MB) are Archean, but the lower crust of the MB has been thermally reactivated during the pan-African Orogeny, whereas that of the craton has not. In addition, both mantle sections have experienced interaction and heating associated with rift magmas. Cratonic lithospheric mantle is compositionally stratified, with highly refractory but strongly LREE-enriched peridotite comprising the bulk of the section (40-130 km depth), underlain by more fertile and deformed peridotites (130-150 km depth), which are also LREE-enriched. Lithospheric mantle of the MB is highly variable in thickness, ranging from a maximum of ˜150 km at Lashaine to <50 km within the Rift axis near the Kenyan border. Like the cratonic lithosphere, this mantle is also refractory and yields Archean Os model ages throughout. Mantle lithospheres of both the TC and MB have interacted with rift magmas, including carbonatites (at Olmani) and alkali basalts (s.l.), which, in some cases, precipitated veins containing phlogopite or amphibole. Late Pleistocene zircons in one of these veins testify to the youth of this interaction. Rift basalt precipitates that formed in the mantle (pyroxenites and glimmerites) and have, thus, never interacted with continental crust, have radiogenic Os isotopic compositions ($\gamma Os = +9$), providing strong evidence for a plume source of the rift magmas. Sr and Nd isotopes in cpx from peridotites are highly variable: in some they are completely overprinted by rift magmas, whereas others contain Archean components. Granulite-facies xenoliths throughout northern Tanzania are generally mafic (including anorthositic compositions), with a few intermediate compositions; no granulite-facies metapelites have been found. Marbles, schists, quartzites and amphibolites from the MB likely derive from middle-crustal depths. All zircon U-Pb ages are Archean ($\geq$ 2.6 Ga) and many of the samples fall along a 2.6 Ga Sm-Nd reference line. U-Pb thermochronology largely records slow cooling in the MB following the Pan-African Orogeny and is consistent with a present-day conductive geotherm of 47 mW/m2 in a crust with very low heat production (see Blondes et al., this meeting). Despite the fact that εNd varies from -4 to -32 in the lower crustal xenoliths, 87Sr/86Sr is much less variable and the data fall along a near-vertical trend in a Sr vs. Nd isotope plot, reflecting ancient Rb depletion relative to Sr. Similarly, the unradiogenic Pb in granulite feldspars from both TC and MB is consistent with ancient U depletion. Collectively, such distinctive radiogenic isotope characteristics can serve as a diagnostic signature of crustal assimilation in rift magmas from northern Tanzania.